SYSTEM AND METHOD FOR ENTERING ALPHANUMERIC CHARACTERS IN A WIRELESS COMMUNICATION DEVICE

FIELD OF THE INVENTION

[0001] The present invention is directed generally to a wireless communication device, and, more particularly, to a system and method for entering alphanumeric characters in a wireless communication device.

BACKGROUND OF THE INVENTION

[0002] Wireless communications devices, such as cellular telephones, typically include a housing, a keypad, a display, and an audio-input device, such as a microphone. In addition, many wireless communications devices can be configured to send messages, to receive commands, to place calls and to store information, such as names and associated addresses.

[0003] A wireless communications device user will frequently desire to input alphanumeric characters, such as the letters of the alphabet, numbers, and other special characters, such as '!', '@', '#', '$', '%', and so forth, for use in conjunction with the operation of the wireless communications device. The user may desire, for example, to input alphanumeric characters for use in connection with sending messages, receiving commands, placing calls, storing information, and the like. To enter alphanumeric characters, the user must use the limited number of keys on the keypad to represent each of the alphanumeric characters. This will frequently require the user to enter several key strokes for each alphanumeric character. It is inconvenient for the user to enter multiple keystrokes for each alphanumeric character to be input. Therefore, it can be appreciated that there is a significant need for a system to enter alphanumeric characters in a wireless communications device without the need to enter one or more keystrokes for each character.

SUMMARY OF THE INVENTION

[0004] The present invention is embodied in a system and method for audio-entry of alphanumeric characters for use in conjunction with the operation of a wireless communications device. In one embodiment the system includes a housing, a keypad, an audio-input device, a memory, a transmitter and a receiver. The system also includes a voice-recognition engine. The voice-recognition engine can be configured to match audio-data received by the audio-input device with a selected one of a set of alphanumeric characters. The alphanumeric characters can then be used in conjunction with the operation of the wireless communications device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0005] FIG. 1 is a functional block diagram of a wireless communication device implementing the present invention.

[0006] FIG. 2 illustrates the operation of FIG. 1 using audio-data to transmit alphanumeric characters to a remote location.

[0007] FIG. 3 is a flowchart illustrating the operation of the system of FIG. 1 to transmit to a remote location an electronic message composed at least in part of alphanumeric characters.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0008] The present invention provides for audio entry of alphanumeric characters in a wireless communications device, and, as a result, reduces user key strokes required for entry of alphanumeric characters in a wireless communications device. The present invention may be readily implemented in any wireless communications device. Although the examples herein refer to a cellular phone, the principles of the present invention are applicable to any wireless communications device, including, but not limited to, analog and digital cellular telephones, personal communications system (PCS) devices, and the like.

[0009] The present invention is embodied in a system **100** illustrated in the functional block of FIG. 1. The system **100** includes a central processing unit (CPU) **102**, which controls operation of the system. A memory **104**, which may include both

read-only memory (ROM) and random-access memories (RAM), provides instructions and data to the CPU **102**. A portion of the memory **104** may also contain non-volatile random-access memory.

[0010] The system **100**, which is typically embodied in a wireless communication device such as a cellular telephone, also includes a housing **106** that contains a transmitter **108** and a receiver **110** to allow transmission and reception of data, such as audio communications and programming data, between the system **100** and a remote location, such as a base transceiver station (BTS) **150** (see FIG. 2). The transmitter **108** and the receiver **110** may be combined into a transceiver **112**. An antenna **114** is attached to the housing **106** and electrically coupled to the transceiver **112**. The operation of the transmitter **108**, receiver **110**, and antenna **114** is well-known in the art and need not be described herein. Although FIG. 1 illustrates the antenna **114** as extending from the housing **106**, some designs may include an internal antenna that is contained completely within the housing. The transmitter **108**, the receiver **110**, and the antenna **114**, however, operate in a conventional manner regardless of the location of the antenna.

[0011] A user-input device **116**, comprising at least an audio-input device **118** is attached to the housing **106** for operation by the user in a conventional manner. The user-input device **116** provides a convenient means by which alphanumeric characters, commands, and other data may be entered by the user. Although FIG. 1 illustrates the user-input device **116** as comprising an audio-input device **118** and a keypad **120**, other user-input devices may be used, including a data input jack (not shown), and the like, and in various combinations. In addition, while the audio-input device **118** may be a microphone (see FIG. 2), one skilled in the art will recognize that other audio-input devices **118** may be used, including an audio-data input jack (not shown), the receiver **110**, and the like, and in various combinations.

[0012] The system 100 also includes a voice-recognition engine 122 providing digital signal processing utilizing appropriate voice-recognition software, conventionally implemented using a dedicated digital signal processor (DSP), not shown.. As will be discussed in greater detail below, system **100** may use the voice-recognition engine to match audio-data to alphanumeric characters, commands,

identifiers, and the like. Voice-recognition engines rely on the ability to correlate user-entered audio-data to words within a previously trained vocabulary set. When the correlation between the user-entered word and a word in the vocabulary set exceeds a predetermined threshold, that word is selected as an appropriate match. One of ordinary skill in the art will be able to determine the details of training the vocabulary set and matching audio-data with a previously trained vocabulary set. Thus, the training of the vocabulary set and the operation of the voice-recognition engine 122 need not be discussed in detail herein. One skilled in the art will recognize that the voice-recognition engine may be configured to analyze and interpret audio-data by the user or may be preset to do so at the factory, or some combination thereof.

[0013] The use of a limited set of alphanumeric characters (*e.g.*, 0-9, a-z, A-Z, and a few special characters) permits the voice-recognition engine **122** to function satisfactorily with a limited vocabulary set. The limited vocabulary set results in the use of fewer system resources, faster training time, and a faster response time from the voice-recognition engine **122**. One skilled in the art will recognize that the limited vocabulary set may also include commands, address identifiers (such as names for use with an address book) and the like.

[0014] The voice-recognition engine **122** may be readily implemented as a series of software instructions placed in the memory **104** and executed by a DSP and/or the CPU 102. Thus, minor software modifications to existing hardware will allow the implementation of the system **100**.

[0015] Electrical components of the system **100** receive power from a battery **124**, which is attached to and supported by the housing **106**. In an exemplary embodiment, the battery **124** is a rechargeable battery. In other embodiments, the system **100** may include a connector (not shown) for the connection of an external power source, such as an automobile power adapter, AC power adapter, or the like.

[0016] The various components of the system **100** are coupled together by a bus system **126** which may include a power bus, control bus, and status signal bus in addition to a data bus. For the sake of clarity, however, the various buses are illustrated in FIG. 1 as the bus system **126**.

[0017] One skilled in the art will recognize that a wireless communication device may use voice-entered alphanumeric characters in conjunction with the operation of the device in different ways. For the sake of brevity, the system **100** will be described using a limited number of examples.

[0018] In one embodiment, the system **100** may be configured to interpret audio-data as matching a selected one of a set of alphanumeric characters and to store the selected character for subsequent use in the operation of the system **100**. In this embodiment, the voice-recognition engine **122** is configured to interpret audio-data as matching a selected one of a set of alphanumeric characters.

[0019] The user provides audio-data to the audio-input device **118**. For example, the user may say "Capital X" to the audio-input device **118**. The voice-recognition engine **122** receives the audio-data from the audio-input device **118**, in this example audio-data corresponding to "Capital X". The voice-recognition engine **122** interprets the audio-data as matching a selected one of a set of alphanumeric characters, in this example the alphanumeric character "X". The selected alphanumeric character is stored in the memory **104**, in this example the alphanumeric character "X", and is available for subsequent use in the operation of the system **100**. For example, the transmitter **108** may transmit the stored alphanumeric character to a remote location, such as the BTS **150**. FIG. 2 illustrates the operation of the system **100** to transmit voice-entered alphanumeric characters to a remote location, such as a BTS **150**.

[0020] In another embodiment, the system **100** is also configured to interpret audio-data as matching a selected one of a set of commands and to execute the selected command. In this embodiment, the voice-recognition engine **122** is configured to also match audio-data to a select one of a set of commands. The user provides audio-data to the audio-input device **118**. The voice-recognition engine **122** receives the audio-data from the audio-input device **118**. The voice-recognition engine **122** interprets the audio-data as matching a selected one of a set of commands. The selected command is executed by the CPU **102**. For example, the user may provide the audio-input device **118** with audio-data corresponding to the "Send"

command. The voice-recognition engine **122** will interpret the audio-data as matching the "Send" command and the CPU **102** will execute the "Send" command.

[0021] In another embodiment, the system **100** may also be configured to store a plurality of selected alphanumeric characters as part of an electronic message to transmit to a remote location. In this embodiment, the voice-recognition engine **122** is configured to interpret audio-data as matching a selected one of a set of alphanumeric characters. The user provides audio-data to the audio-input device **118**. The voice-recognition engine **122** receives the audio-data from the audio-input device **118** and interprets the audio-data as matching a selected one of a set of alphanumeric characters. A plurality of selected alphanumeric characters are stored in the memory **104** as part of an electronic message. The transmitter **108** transmits the electronic message to a remote location, such as the BTS **150** (see FIG. 2). One skilled in the art will recognize that the electronic message may contain other data, such as a header or additional alphanumeric characters, and the like.

[0022] In another embodiment, the system **100** also will be configured to match audio-data to a selected one of a set of commands, as described above, to process the electronic message. In this embodiment, for example, the user may provide the following audio-data to the audio-input device **118**: "Capital H", "I", "Exclamation Point", and "Send". The voice-recognition engine **122** receives the audio-data from the audio-input device **118** and interprets the audio-data as matching the alphanumeric characters "H", "i", "!", and the command "send". The alphanumeric characters "H", "i", "!" are stored in the memory **104** as part of an electronic message. The CPU **102** executes the "Send" command and the transmitter **108** transmits the electronic message to a remote location, such as the BTS **150** (see FIG. 2). One skilled in the art will recognize that the electronic message may be compatible with various electronic message formats and protocols, such as a short-messaging-service protocol and the like.

[0023] In another embodiment, the system **100** may also be configured to associate a plurality of selected alphanumeric characters with an address-identifier, and to store the plurality of selected alphanumeric characters and the associated address-identifier. In this embodiment, the voice-recognition engine **122** is configured

to interpret audio-data as matching a selected one of a set of alphanumeric characters. The user provides audio-data to the audio-input device **118**. The voice-recognition engine **122** receives the audio-data from the audio-input device **118** and interprets the audio-data as matching a selected one of a set of alphanumeric characters. A plurality of selected alphanumeric characters are associated with an address-identifier by the CPU **102**. One skilled in the art will also recognize that the plurality of alphanumeric characters may represent at least part of a destination telephone number, an electronic address, a street address, or the like. A typical wireless communication device allocates a portion of the memory **104** to serve the function of an electronic phone book. The plurality of selected alphanumeric characters and the associated address-identifier are stored in the memory **104** for subsequent use. One skilled in the art will recognize that the address-identifier may be associated with other data, such as a header or additional alphanumeric characters, and the like.

[0024] In an exemplary embodiment, the system **100** also will be configured to interpret the audio-data as matching a selected one of a set of commands, as described above, to process the plurality of selected alphanumeric characters and the associated address-identifier, and to interpret the audio-data as the address-identifier. In this embodiment, for example, the user may provide the following audio-data to the audio-input device **118**: "Name", "John Doe", "Number", "5", "5", "5", "1", "2", "1", "2", and "Store". The voice-recognition engine **122** receives the audio-data from the audio-input device **118** and interprets the audio-data as: matching the command "Name"; containing the address identifier "John Doe"; matching the command "Number"; matching the alphanumeric characters "5", "5", "5", "1", "2", "1", "2"; and as matching the command "Store".

[0025] In this example, the CPU **102** executes the "Name" command by configuring the voice-recognition engine **122** to interpret subsequent audio-data as the address-identifier. The CPU **102** executes the "Number" command by configuring the voice-recognition engine **122** to interpret subsequent audio-data as matching a selected one of a set of alphanumeric characters. The CPU **102** associates the alphanumeric characters "5", "5", "5", "1", "2", "1", "2" with the address-identifier "John Doe" and executes the "Store" command by storing the alphanumeric

characters "5", "5", "5", "1", "2", "1", "2" and the associated address-identifier "John Doe" in the memory **104**.

[0026] Those skilled in the art will recognize that the voice-recognition engine **122** may be configured to properly interpret the audio-data as a command, an alphanumeric character, an address identifier, or other information through other means. For example, the system **100** may be configured to interpret the audio-data as either a command, an alphanumeric character, an address identifier, or other information based upon the position of the audio-data in the data stream. Alternatively, the user may use the keypad **120** to enter commands which tell the system **100** to interpret the audio-data properly. The system **100** might also use a sequencing scheme. For example, the voice-recognition engine **122** may be configured to attempt a command match first. If there is no match, the voice-recognition engine **122** may be configured to then attempt to match the audio-data to a selected alphanumeric character, and so forth.

[0027] Those skilled in the art will also recognize that the audio-data, selected alphanumeric characters, uses of the audio-data, selected commands, electronic messages and address-identifiers used above are illustrative only and that the present invention is not limited to the specific audio-data, selected alphanumeric characters, uses of the audio-data, selected commands, electronic messages or address-identifiers mentioned.

[0028] The operation of the system **100** to transmit to a remote location an electronic message composed at least in part of alphanumeric characters received by a wireless communications device via an audio-input device **118** is illustrated in FIG. 3. At a start **160**, the wireless communication device is under power. At step **162** the system receives audio-data from the audio-input device **118**. At step **164** the voice recognition engine **122** interprets the audio-data as matching a selected one of a set of alphanumeric characters. At step **166** the system **100** stores the selected alphanumeric character as part of an electronic message. At decision **168** the system determines whether the electronic message is complete. For example, the voice-recognition engine **122** may interpret the audio-data as a command, such as "Send", that indicates an end to the electronic message. One skilled in the art will recognize that the system

100 may determine that the electronic message is complete through other means, such as a time-out routine or user-entry of a "Send" command through the keypad **120**.

[0029] If the electronic message is not complete, the result of decision **168** is NO. In that event, the system **100** returns to step **162** to receive additional audio-data.

[0030] If the electronic message is complete, the result of decision **168** is YES. In that event, the system **100** transmits the electronic message in step **170**. The system ends the operation in step **172**. Those skilled in the art will recognize that additional steps, such as error-checking routines and, as discussed above, audio-entry of commands to process the electronic message, and the like, may be performed. For the sake of brevity, those flowcharts will not be repeated herein. However, those of ordinary skill in the art may readily implement such processes based on the present disclosure.

[0031] It is to be understood that even though various embodiments and advantages of the present invention have been set forth in the foregoing description, the above disclosure is illustrative only, and changes may be made in detail, yet remain within the broad principles of the invention. Therefore, the present invention is to be limited only by the appended claims.